

CLAIMS

1. A filter cartridge prepared by winding a strip of nonwoven comprising a thermoplastic fiber obtained by bonding at least a part of the fiber intersections in a twill form so as to make a cylindrical form, wherein a filtration layer comprises a first filtration layer and a second filtration layer; the first filtration layer comprises a filament nonwoven; and an initial 80% trapped particle diameter in the second filtration layer is 0.05 to 0.9 time as large as an initial 80% trapped particle diameter in the first filtration layer.

2. The filter cartridge as described in claim 1, wherein the strip of filament nonwoven is turned into a pleated matter having 4 to 50 pleats and wound around a perforated cylinder in a twill form.

3. The filter cartridge as described in claim 2, wherein at least a part of the pleats of the pleated matter is arranged in non-parallel.

4. The filter cartridge as described in claim 2, wherein the pleated matter has a void rate of 60 to 95%.

5. The filter cartridge as described in any of claims 1 to 4, wherein the first filtration layer of the filter cartridge has a void rate of 65 to 90%.

6. The filter cartridge as described in claim 1, wherein the second filtration layer is prepared by winding a

perforated sheet around a perforated cylinder in a layer form.

7. The filter cartridge as described in claim 1, wherein the second filtration layer has a two-layer structure comprising a filtration layer (a) prepared by winding a strip of filament nonwoven comprising a thermoplastic fiber prepared by bonding at least a part of fiber intersections around a perforated cylinder in a twill form and a filtration layer (b) in which the strip of filament nonwoven is continuously wound from the filtration layer (a) in a twill form while winding a perforated sheet in a layer form; and the first filtration layer is a filtration layer in which the strip of filament nonwoven is continuously wound from the second filtration layer in a twill form.

8. The filter cartridge as described in claim 1, wherein the second filtration layer is prepared by folding a perforated sheet around a perforated cylinder in a pleat form and molding it in a cylindrical form.

9. A filter cartridge prepared by winding a strip of nonwoven having aperture parts and comprising a thermoplastic fiber obtained by bonding at least a part of fiber intersections around a perforated cylinder in a twill form.

10. The filter cartridge as described in claim 9, wherein the strip of nonwoven having aperture parts is a

pleated matter having 4 to 50 pleats.

11. The filter cartridge as described in claim 9 or 10, wherein the aperture part has an area ratio of 5 to 60% based on the whole area of the strip of nonwoven having aperture parts.

12. The filter cartridge as described in any of claims 9 to 11, wherein a porous material other than the strip of nonwoven having an aperture part is used for a part of the filtration layer in the filter cartridge.

13. A filter cartridge prepared by winding a strip of nonwoven comprising a thermoplastic fiber obtained by bonding at least a part of fiber intersections around a perforated cylinder in a twill form, wherein end face-sealed parts are provided at both end parts thereof.

14. The filter cartridge as described in claim 13, wherein the both end face parts are sealed by melting or softening the strip of nonwoven constituting both end parts of the filter cartridge thereby integrating them with the nonwoven.

15. The filter cartridge as described in claim 13, wherein the end face-sealed parts are formed by combining a sheet comprising the same resin as at least one of the thermoplastic resins used for the strip of nonwoven constituting both end parts on the surfaces of both end parts of the filter cartridge and melting or softening the sheet, thereby integrating it with the nonwoven.

16. A filter cartridge prepared by winding a strip of nonwoven comprising a thermoplastic fiber obtained by bonding at least a part of fiber intersections around a perforated cylinder in a twill form, wherein the nonwoven has a tongue section part.

17. The filter cartridge as described in claim 16, wherein the tongue section part has an area ratio of 10 to 80% based on the whole area of the strip of nonwoven having a tongue section part.

18. The filter cartridge as described in claim 16 or 17, wherein a porous material other than the strip of filament nonwoven having a tongue section part is used for a part of the filtration layer in the filter cartridge.

19. A filter cartridge prepared by winding a strip of nonwoven comprising a thermoplastic fiber obtained by bonding at least a part of fiber intersections around a perforated cylinder in a twill form, wherein at least two of the nonwovens comprising a thermoplastic fiber are concurrently wound around the perforated cylinder.

20. The filter cartridge as described in claim 19, wherein the widths of the strip of nonwoven are designated as  $L_1, L_2, L_3, \dots, L_n$  (mm), and the winding numbers of the strip of nonwovens having the respective widths are designated as  $N_1, N_2, N_3, \dots, N_n$ ; the relation between the former and the latter being expressed by the following equation (A):

$$7 \leq (L_1 \times N_1) + (L_2 \times N_2) + \dots + (L_n \times N_n) \leq 150$$

(provided that the total of  $N_1 + N_2 + \dots + N_n$  is an integer of 2 or more).

21. The filter cartridge as described in any of claims 1, 9, 13, 16 and 19, wherein the thermoplastic fiber is a thermally adherent composite fiber comprising a low melting point resin and a high melting point resin, difference in melting point between both resins being 10°C or more.

22. The filter cartridge as described in claim 21, wherein the low melting point resin is a linear low density polyethylene and the high melting point resin is a polypropylene.

23. The filter cartridge as described in any of claims 1, 9, 13, 16 and 19, wherein fiber intersections in the strip of nonwoven are bonded by thermal compression bonding by means of a hot embossing roll.

24. The filter cartridge as described in any of claims 1, 9, 13, 16 and 19, wherein fiber intersections in the strip of nonwoven are bonded by hot air.

25. The filter cartridge as described in any of claims 1, 9, 13, 16 and 19, wherein the strip of nonwoven is twisted.

26. The filter cartridge as described in any of claims 9, 13, 16 and 19, wherein the filtration layer of the filter cartridge has a void rate of 65 to 90%.

27. The filter cartridge as described in any of claims

9, 13, 16 and 19, wherein the strip of nonwoven comprises at least 30% by weight of the thermoplastic fiber.

28. The filter cartridge as described in any of claims 1, 9, 13, 16 and 19, wherein the strip of nonwoven has a width of 0.5 cm or more, and a product of a width (cm) and a mass per unit area ( $\text{g}/\text{cm}^2$ ) of the strip of nonwoven is 200 or less.

29. The filter cartridge as described in any of claims 9, 13, 16 and 19, wherein the strip of nonwoven is a filament nonwoven.